Operating Instructions

Capacitive rod electrode for continuous level measurement of adhesive products

VEGACAL 64

For connection to a signal conditioning instrument

Document ID: 30319

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Supplementary documentation

Information:
Supplementary documents appropriate to the ordered version come with the delivery. You can find them listed in chapter "*Product description*".

Instructions manuals for accessories and replacement parts

Tip:
To ensure reliable setup and operation of your VEGACAL 64, we offer accessories and replacement parts. The corresponding documentations are:

- 27720 - VEGADIS 61
- 30531 - Electronics module VEGACAL series 60
- 34296 - Protective cover
- 31088 - Flanges according to DIN-EN-ASME-JIS

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1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup as well as important instructions for maintenance and fault rectification. Please read this information before putting the instrument into operation and keep this manual accessible in the immediate vicinity of the device.

1.2 Target group

This operating instructions manual is directed to trained specialist personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbolism used

Information, tip, note
This symbol indicates helpful additional information.

Caution: If this warning is ignored, faults or malfunctions can result.

Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.

Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.

Ex applications
This symbol indicates special instructions for Ex applications.

- **List**
  The dot set in front indicates a list with no implied sequence.

→ **Action**
This arrow indicates a single action.

1 **Sequence of actions**
Numbers set in front indicate successive steps in a procedure.

Battery disposal
This symbol indicates special information about the disposal of batteries and accumulators.

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2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained specialist personnel authorised by the plant operator.

During work on and with the device the required personal protective equipment must always be worn.

2.2 Appropriate use

VEGACAL 64 is a sensor for continuous level measurement.

You can find detailed information on the application range in chapter "*Product description*".

Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions manual as well as possible supplementary instructions.

For safety and warranty reasons, any invasive work on the device beyond that described in the operating instructions manual may be carried out only by personnel authorised by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden.

2.3 Warning about incorrect use

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

This is a state-of-the-art instrument complying with all prevailing regulations and guidelines. The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for the trouble-free operation of the instrument.

During the entire duration of use, the user is obliged to determine the compliance of the necessary occupational safety measures with the current valid rules and regulations and also take note of new regulations.

The safety instructions in this operating instructions manual, the national installation standards as well as the valid safety regulations and accident prevention rules must be observed by the user.

For safety and warranty reasons, any invasive work on the device beyond that described in the operating instructions manual may be carried out only by personnel authorised by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden.

The safety approval markings and safety tips on the device must also be observed.

2.5 Safety label on the instrument

The safety approval markings and safety tips on the device must be observed.

2.6 CE conformity

This device fulfills the legal requirements of the applicable EC guidelines. By attaching the CE mark, VEGA provides a confirmation of successful testing. You can find the CE conformity declaration in the download area of "www.vega.com".

2.7 Safety instructions for Ex areas

Please note the Ex-specific safety information for installation and operation in Ex areas. These safety instructions are part of the operating instructions manual and come with the Ex-approved instruments.

2.8 Environmental instructions

Protection of the environment is one of our most important duties. That is why we have introduced an environment management system with the goal of continuously improving company environmental protection. The environment management system is certified according to DIN EN ISO 14001.

Please help us fulfill this obligation by observing the environmental instructions in this manual:

- Chapter "*Packaging, transport and storage*"
- Chapter "*Disposal*"

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- Level sensor VEGACAL 64
- Documentation
  - this operating instructions manual
  - Operating instructions manual 27835 "*Display and adjustment module PLICSCOM*" (optional)
  - Supplementary instructions manual 31708 "*Heating for display and adjustment module*" (optional)
  - Supplementary instructions manual "*Plug connector for continuously measuring sensors*" (optional)
  - Ex-specific "*Safety instructions*" (with Ex versions)
  - if necessary, further certificates

Constituent parts

The VEGACAL 64 consists of the components:

- Process fitting with probe
- Housing with electronics
- Housing cover

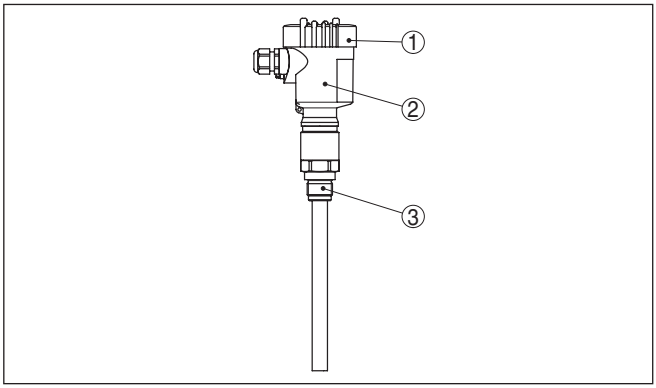

Fig. 1: VEGACAL 64 - rod version with plastic housing

1 Housing cover
2 Housing with electronics
3 Process fitting

Type plate

The nameplate contains the most important data for identification and use of the instrument:

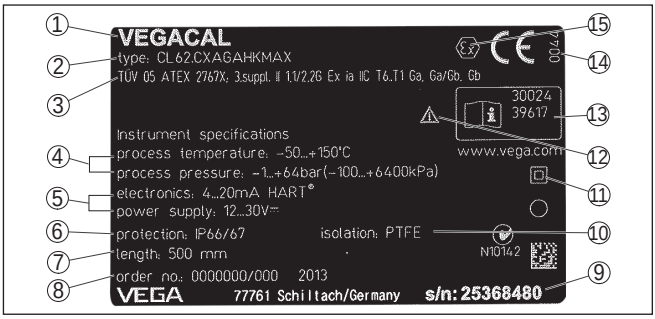

Fig. 2: Layout of the type label (example)

1 *Instrument type*
2 *Product code*
3 *Approvals*
4 *Process and ambient temperature, process pressure*
5 *Power supply and signal output, electronics*
6 *Protection rating*
7 *Probe length*
8 *Order number*
9 *Serial number of the instrument*
10 *Material, wetted parts*
11 *Symbol of the device protection class*
12 *Reminder to observe the instrument documentation*
13 *ID numbers, instrument documentation*
14 *Notified authority for CE marking*
15 *Approval directives*

With the serial number, you can access the delivery data of the instrument via www.vega.com, "*VEGA Tools*" and "*serial number search*". In addition to the type label outside, you can also find the serial number on the inside of the instrument.

3.2 Principle of operation

Area of application

VEGACAL 64 is a level sensor with fully insulated probe for continuous level measurement.

The electronics functions according to the admittance principle (phase-selective admittance processing).

It is designed for industrial use in all areas of process technology and can be applied in all areas of industrial process measurement.

Fully insulated probes such as VEGACAL 64 are preferably used in conductive liquids.

Fully insulated probes like VEGACAL 64 are preferably used in conductive, very adhesive liquids.

The capacitive measuring principle places no special requirements on installation. Hence, many different applications can be equipped with VEGACAL 64.

The instrument can also be used problem-free in corrosive products.

Functional principle

Probe, measured product and vessel wall form an electrical capacitor. The capacitance is influenced by three main factors.

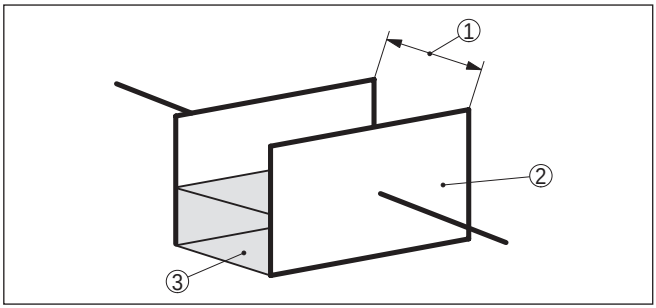

Fig. 3: Functional principle - Plate capacitor

1 Distance between the electrode surfaces
2 Size of the electrode surfaces
3 Type of dielectric between the electrodes

The probe and the vessel wall are the capacitor plates. The measured product and the insulation are the dielectric. Due to the higher dielectric constant of the insulation and the conductive product compared to air, the capacitance increases as the probe is gradually covered.

The capacitance as well as the resistance change are converted by the electronics module into a level-proportional signal.

Voltage supply

4 … 20 mA two-wire electronics for voltage supply and measured value transmission on the same cable.

The supply voltage range can differ depending on the instrument version.

The data for power supply are specified in chapter "*Technical data*".

3.3 Operation

VEGACAL 64 measurement signals can be evaluated with the following:

- With a VEGAMET signal conditioning instrument

The measuring range must be selected on the electronics module of the probe.

The full and empty adjustment can be carried out on a VEGAMET signal conditioning instrument or the analogue input card of a PLC.

3.4 Packaging, transport and storage

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test based on ISO 4180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Transport

Transport must be carried out in due consideration of the notes on the transport packaging. Nonobservance of these instructions can cause damage to the device.

Transport inspection

The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with.

Storage

Up to the time of installation, the packages must be left closed and stored according to the orientation and storage markings on the outside.

Unless otherwise indicated, the packages must be stored only under the following conditions:

- Not in the open
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration

Storage and transport temperature

- Storage and transport temperature see chapter "*Supplement - Technical data - Ambient conditions*"
- Relative humidity 20 … 85 %

3.5 Accessories and replacement parts

PLICSCOM

The display and adjustment module PLICSCOM is used for measured value indication, adjustment and diagnosis. It can be inserted into the sensor or the external display and adjustment unit and removed at any time.

You can find further information in the operating instructions "*Display and adjustment module PLICSCOM*" (Document-ID 27835).

VEGACONNECT

The interface adapter VEGACONNECT enables the connection of communication-capable instruments to the USB interface of a PC. For parameter adjustment of these instruments, the adjustment software PACTware with VEGA-DTM is required.

You can find further information in the operating instructions "*Interface adapter VEGACONNECT*" (Document-ID 32628).

VEGADIS 62

VEGADIS 62 is suitable for measured value indication and adjustment of sensors with HART protocol. It is looped into the 4 … 20 mA/HART signal cable.

You can find further information in the operating instructions "*VEGADIS 62*" (Document-ID 36469).

Protective cap

The protective cover protects the sensor housing against soiling and intense heat from solar radiation.

You will find additional information in the supplementary instructions manual "*Protective cover*" (Document-ID 34296).

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Flanges

Screwed flanges are available in different versions according to the following standards: DIN 2501, EN 1092-1, BS 10, ANSI B 16.5, JIS B 2210-1984, GOST 12821-80.

You can find additional information in the supplementary instructions manual "*Flanges according to DIN-EN-ASME-JIS*" (Document-ID 31088).

Screening tube adapter

Condensation

In case of strong condensation, the draining of condensed water can change the measurement accuracy. The suitable version is the **Screening against condensation**. The condensation can drain off outside on the screening tube adapter.

Typical applications of the screening tube adapters are e.g. for condensation or sockets. Apart from the standard version, there is a second version for vacuum with a sepcial seal. When the screening tube adapter is submerged in liquid, we recommend the use of a vacuum-tight version.

Socket

In case of long sockets, the screening tube can increase the sensitivity of the probe by compensating the influences of the socket. The suitable version is **Capacitive screening, vacuum-tight**.

When the probe is mounted laterally, buildup can accumulate in the socket. A screening tube makes the covered part of the probe inactive and hence insensitive to influence from buildup and socket. Hence, the screening tube adapter excludes changing influences caused by the medium and ensures stable measurement conditions. The suitable version is **Capacitive screening, vacuum-tight**.

4 Mounting

4.1 General instructions

Suitability for the process conditions

Make sure that all parts of the instrument coming in direct contact with the process, especially the sensor element, process seal and process fitting, are suitable for the existing process conditions, such as process pressure, process temperature as well as the chemical properties of the medium.

You can find the specifications in chapter "*Technical data*" and on the nameplate.

Installation position

Select such a mounting location that the instrument is within easy reach for mounting and connecting. For this purpose the housing can be rotated by 330° without any tools being required.

Welding work

Before beginning the welding work, remove the electronics module from the sensor. By doing this, you avoid damage to the electronics through inductive coupling.

Handling

With threaded versions, the housing must not be used to screw in the instrument. Applying tightening forces on the housing can damage its internal parts.

Use the hexagon for screwing in.

Moisture

Use the recommended cables (see chapter "*Connecting to power supply*") and tighten the cable gland.

You can give your instrument additional protection against moisture penetration by leading the connection cable downward in front of the cable entry. Rain and condensation water can thus drain off. This applies mainly to outdoor mounting as well as installation in areas where high humidity is expected (e.g. through cleaning processes) or on cooled or heated vessels.

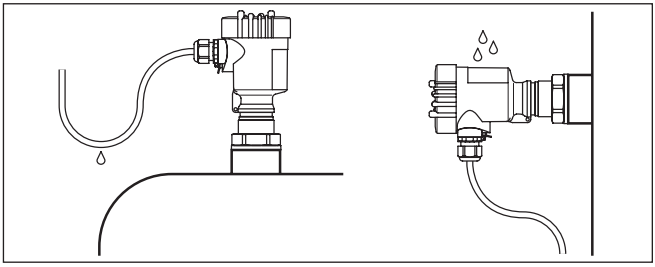

Fig. 4: Measures against moisture penetration

Pressure/Vacuum

The process fitting must be sealed if there is gauge or low pressure in the vessel. Before use, check if the seal material is resistant against the measured product and the process temperature.

The max. permissible pressure is specified in chapter "*Technical data*" or on the type label of the sensor.

Insulating measures, such as e.g. covering the thread with teflon tape, can interrupt the necessary electrical connection with metal vessels. For this reason, ground the probe on the vessel or use a conductive seal material.

Vessel material

Metal vessel

Make sure that the mechanical connection of the probe to the vessel is electrically conductive to ensure sufficient grounding.

Use conductive seals, such as those made of copper or lead, etc. Insulating measures, such as covering the thread with Teflon tape, can interrupt the necessary electrical connection with metal vessels. For this reason, ground the probe on the vessel or use a conductive seal material.

Non-conductive vessels

In non-conductive vessels, e.g. plastic tanks, the second pole of the capacitor must be provided separately.

Vessel forms

If possible, the capacitive probe should be mounted vertically or parallel to the counter electrode. This applies particularly to applications in non-conductive products.

In cylindrical tanks, spherical tanks or other asymmetrical tank forms, nonlinear level values are generated due to the varying distance to the vessel wall.

Use a concentric tube in non-conductive products or linearize the meas. signal.

4.2 Mounting instructions

Installation position

During operation, the probe must not touch any installations or the vessel wall. The measured value can also change if the distance to the vessel wall changes considerably. If necessary, secure the end of the probe (insulated).

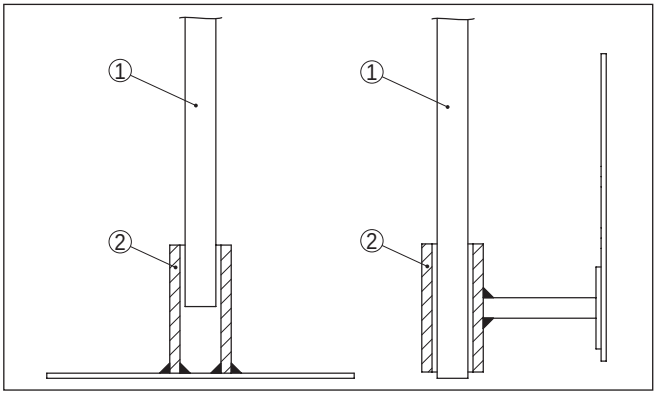

Fig. 5: Fasten the probe

1 Probe
2 Plastic socket

In vessels with conical bottom it can be advantageous to mount the sensor in the center of the vessel, as measurement is then possible down to the lowest point of the vessel bottom.

Inflowing medium

If the instrument is mounted in the filling stream, unwanted false measurement signals can be generated. For this reason, mount the instrument at a position in the vessel where no disturbances, e.g. from filling openings, agitators, etc., can occur.

This applies particularly to instrument versions with a longer probe.

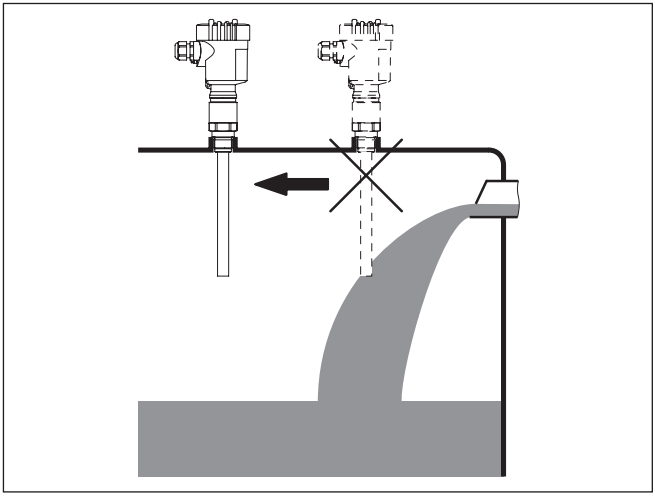

Fig. 6: Inflowing medium

5 Connecting to power supply

5.1 Preparing the connection

Note safety instructions

Always keep in mind the following safety instructions:

- Connect only in the complete absence of line voltage
- If overvoltage surges are expected, overvoltage arresters should be installed

Tip:
We recommend using VEGA overvoltage arresters B63-48 and ÜSB 62-36G.X.

Take note of safety instructions for Ex applications

In hazardous areas you must take note of the respective regulations, conformity and type approval certificates of the sensors and power supply units.

Voltage supply

Power supply and current signal are carried on the same two-wire cable. The voltage supply range can differ depending on the instrument version.

The data for power supply are specified in chapter "*Technical data*".

Provide a reliable separation between the supply circuit and the mains circuits according to DIN VDE 0106 part 101. The VEGA power supply units VEGATRENN 149AEx, VEGASTAB 690, VEGADIS 371 as well as all VEGAMETs meet this requirement.

Keep in mind the following additional factors that influence the operating voltage:

- Output voltage of the power supply unit can be lower under nominal load (with a sensor current of 20.5 mA or 22 mA in case of fault message)
- Influence of additional instruments in the circuit (see load values in chapter "*Technical data*")

Connection cable

The instrument is connected with standard two-wire cable without screen. If electromagnetic interference is expected which is above the test values of EN 61326 for industrial areas, screened cable should be used.

Use cable with round cross-section. A cable outer diameter of 5 … 9 mm (0.2 … 0.35 in) ensures the seal effect of the cable gland. If you are using cable with a different diameter or cross-section, exchange the seal or use a suitable cable gland.

Cable screening and grounding

If screened cable is necessary, connect the cable screen on both ends to ground potential. In the sensor, the screen must be connected directly to the internal ground terminal. The ground terminal on the outside of the housing must be connected to the potential equalisation (low impedance).

If potential equalisation currents are expected, the connection on the processing side must be made via a ceramic capacitor (e. g. 1 nF, 1500 V). The low-frequency potential equalisation currents are thus

suppressed, but the protective effect against high frequency interference signals remains.

Connection cable for Ex applications

Take note of the corresponding installation regulations for Ex applications. In particular, make sure that no potential equalisation currents flow over the cable screen. In case of grounding on both sides this can be achieved by the use of a capacitor or a separate potential equalisation.

5.2 Connection procedure

Proceed as follows:

1. Unscrew the housing cover
2. Loosen compression nut of the cable entry
3. Remove approx. 10 cm (4 in) of the cable mantle, strip approx. 1 cm (0.4 in) of insulation from the ends of the individual wires
4. Insert the cable into the sensor through the cable entry
5. Lift the opening levers of the terminals with a screwdriver (see following illustration)
6. Insert the wire ends into the open terminals according to the wiring plan
7. Press down the opening levers of the terminals, you will hear the terminal spring closing
8. Check the hold of the wires in the terminals by lightly pulling on them
9. Connect the screen to the internal ground terminal, connect the outer ground terminal to potential equalisation
10. Tighten the compression nut of the cable entry. The seal ring must completely encircle the cable
11. Screw the housing cover back on

The electrical connection is hence finished.

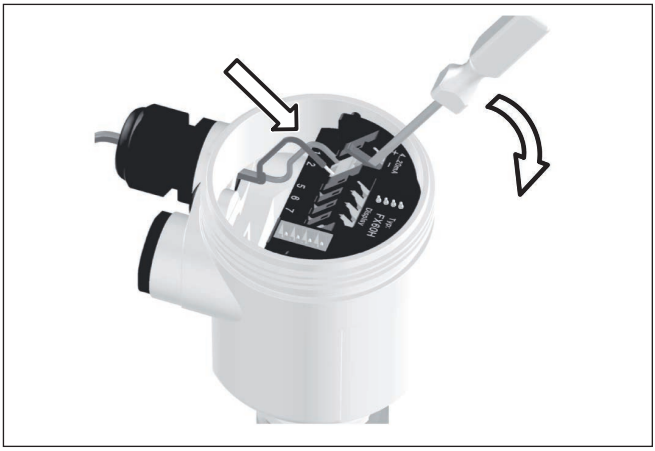

Fig. 7: Connection steps 6 and 7

5.3 Wiring plan, single chamber housing

The following illustrations apply to the non-Ex as well as to the Ex-ia version.

Housing overview

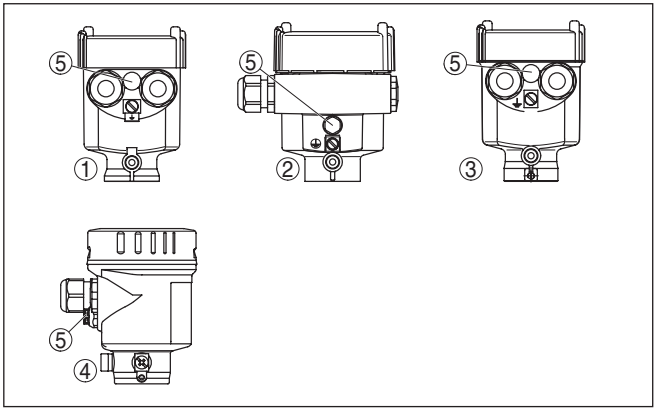

Fig. 8: Material versions, single chamber housing

1 *Plastic*
2 *Aluminium*
3 *Stainless steel, investment casting*
4 *Stainless steel, electro-polished*
5 *Filter element for air pressure compensation of all material versions. Blind plug with version IP 66/IP 68, 1 bar for Aluminium and stainless steel*

Electronics and connection compartment

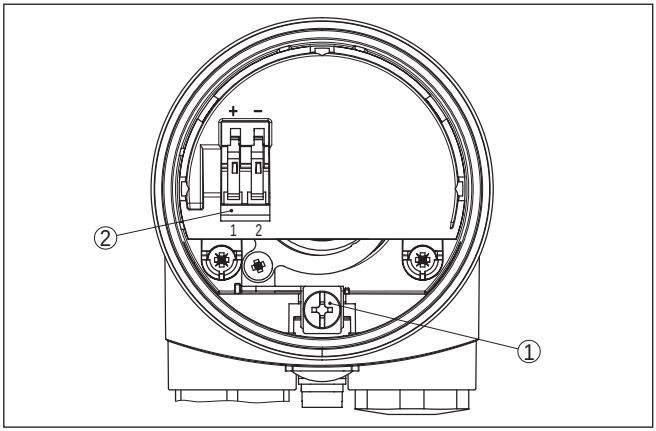

Fig. 9: Electronics and connection compartment, single chamber housing

1 *Ground terminal for connection of the cable screen*
2 *Spring-loaded terminals for voltage supply*

Wiring plan

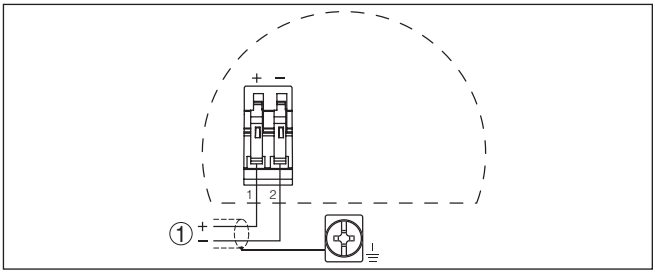

Fig. 10: Wiring plan, single chamber housing

1 Voltage supply/Signal output

5.4 Wiring plan - version IP 66/IP 68, 1 bar

Wire assignment, connection cable

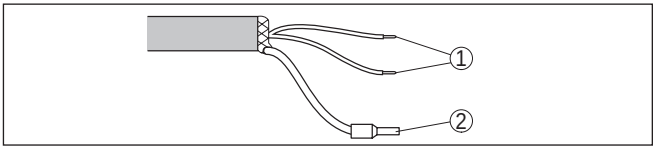

Fig. 11: Wire assignment, connection cable

1 brown (+) and blue (-) to power supply or to the processing system
2 Shielding

6 Setup with a signal conditioning instrument

6.1 General information

Function/Configuration

During setup, the probe must be calibrated with the medium that will later be measured. To adjust the probe, open the housing cover. You can select the sensitivity range on the electronics module by means of the measuring range selection switch.

- range 1: 0 … 120 pF
- Range 2: 0 … 600 pF
- Range 3: 0 … 3000 pF

The adjustment is described in the operating instructions manual of the respective signal conditioning instrument.

6.2 Adjustment system

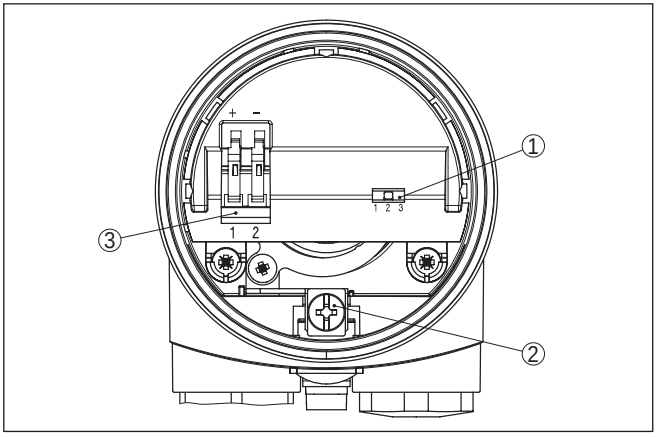

Fig. 12: Display and adjustment elements - Oscillator

1 DIL switch for measuring range selection
2 Ground terminal
3 Connection terminals

Measuring range selection switch (1)

With the measuring range selection switch (1) you can adapt the sensitivity of the probe to the electrical properties of the measured medium and the conditions in the vessel. This is necessary to ensure that the output current range is a big as possible. The resolution of the probe is thus also correspondingly increased.

Due to this, the probe can for example also detect products with very low or very high dielectric constant reliably.

- range 1 (sensitive): 0 … 120 pF
- range 2 (standard): 0 … 600 pF
- range 3 (less sensitive): 0 … 3000 pF

6.3 Continuous level measurement

General information

Continuous measurement requires a constant dielectric value, i.e. the measured product should have constant properties.

Select the stage with the measuring range selection switch on the electronics module of the probe according to the following chart.

Look in the row that corresponds to your product and select an appropriate range according to the length of your probe.

The listed lengths do not completely correspond to those of the actually available measuring probes. If the product has a dielectric constant that lies between the values stated in the chart, the max. permissible probe length for each range must be calculated accordingly. For longer lengths or if there is no information available in the chart, select range 3. If you are not sure, always set the measuring range selection switch to the next higher stage.

	VEGACAL 64	VEGACAL 64 with concentric tube
non-conductive and dielectric constant = 2	0 - 6 m = range 1	0 - 2 m = range 1
non-conductive and dielectric constant = 10	0 - 1 m = range 1 / 1 - 5.5 m = range 2	0 - 0.4 m = range 1 / 0.4 - 2 m = range 2
conductive or dielectric constant > 50	0 - 0.15 m = range 1; 0.15 - 0.8 m = range 2	0 - 0.15 m = range 1; 0.15 - 0.9 m = range 2

Tab. 1: Range setting

Tip:
For min. adjustment the vessel should be as empty as possible, and for max. adjustment, as full as possible. If the vessel is already full, start with max. adjustment.

VEGAMET series 500 signal conditioning instrument

1. Set range changeover switch on the capacitive probe according to the above chart
2. Carry out the adjustment on the signal conditioning instrument (see operating instructions manual of the signal conditioning instrument: "Adjustment with medium")

If error E014 is outputted on the signal conditioning instrument, you will find information in the operating instructions manual of the signal conditioning instrument under„Error codes“. If the sensor and supply cable are working properly, it may be that an incorrect range has been set for the capacitive probe. Set the measuring range selection switch to the next higher stage.

If error E017 is outputted on the signal conditioning instrument, set the measuring range selection switch on the probe one step lower.

VEGAMET series 600 signal conditioning instrument, analogue input card of a PLC

1. Set range changeover switch on the capacitive probe according to the above chart
2. Carry out the adjustment on the signal conditioning instrument (see operating instructions manual of the signal conditioning instrument: "Adjustment with medium")

   When connecting to an analogue input card of a PLC, take note of the operating instructions manual of the input card. The vessel

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must be as empty as possible for empty adjustment and as full as possible for full adjustment.

If the indication cannot be set to 100 %, proceed as follows:

If the indication does not reach 100 %, you have to set the range selection switch on the probe one stage lower.

If the indication exceeds 100 % and cannot be reset, you have to set the range selection switch of the probe to the next higher stage. In both cases you have to repeat the adjustment.

7 Maintenance and fault rectification

7.1 Maintenance

If the instrument is used properly, no special maintenance is required in normal operation.

7.2 Rectify faults

Reaction when malfunctions occur

The operator of the system is responsible for taking suitable measures to rectify faults.

Failure reasons

VEGACAL 64 offers maximum reliability. Nevertheless, faults can occur during operation. These may be caused by the following, e.g.:

- Sensor
- Process
- Voltage supply
- Signal processing

Fault rectification

The first measure to be taken is to check the output signal. In many cases, the causes can be determined this way and the faults rectified.

24 hour service hotline

Should these measures not be successful, please call in urgent cases the VEGA service hotline under the phone no. **+49 1805 858550**.

The hotline is available to you 7 days a week round-the-clock. Since we offer this service world-wide, the support is only available in the English language. The service is free of charge, only the standard telephone costs will be charged.

Checking the current signal

Disconnect the signal cable and connect a multimeter with a suitable measuring range.

Error	Cause	Rectification
Current signal not stable	Level fluctuations	Adjust damping in the signal conditioning instrument or process control system
Current signal missing	Wrong connection to voltage supply	Check connection according to chapter "*Connection steps*" and if necessary, correct according to chapter "*Wiring plan*"
	No power supply	Check cables for breaks; repair if necessary
	Operating voltage too low or load resistance too high	Check, adapt if necessary

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Error	Cause	Rectification
Current signal >22 mA	Probe insulation damaged, short-circuit due to permeating, conductive medium	Exchange the instrument or send it in for repair
	Shortcircuit in the probe, e.g. because of moisture in the housing	Remove the electronics module. Check the resistance between the marked plug connections. See the following instructions.
	Electronics module defective	Exchange the instrument or send it in for repair

Check the resistance in the probe

Remove the electronics module. Check the resistance between the two plug connections.

There must no longer be a connection (high impedance). If there is still a connection - exchange the instrument or return it for repair

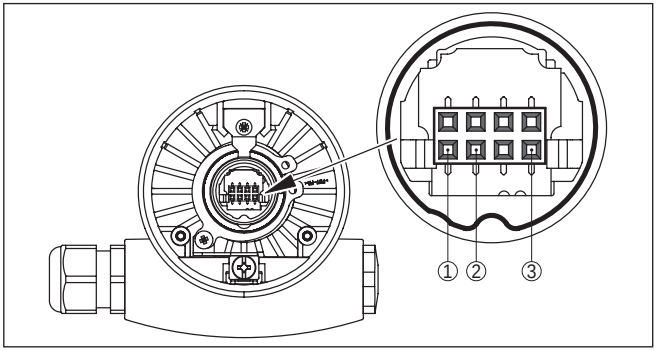

Fig. 13: Check the resistance in the probe

1 Shielding
2 Probe
3 Ground potential

In Ex applications, the regulations for the wiring of intrinsically safe circuits must be observed.

Reaction after fault rectification

Depending on the reason for the fault and the measures taken, the steps described in chapter "*Set up*" may have to be carried out again.

7.3 Exchanging the electronics module

If the electronics module is defective, it can be replaced by the user.

In Ex applications only one instrument and one electronics module with respective Ex approval may be used.

If there is no electronics module available on site, one can be ordered from the VEGA agency serving you.

Assignment

The electronics modules are adapted to the respective sensor. You can find a suitable electronics module in the following overview.

- CL-E60**Z**X (without approvals)

7.4 How to proceed in case of repair

You can find a repair form as well as detailed information on how to proceed under www.vega.com/downloads and "*Forms and certificates*".

By doing this you help us carry out the repair quickly and without having to call back for needed information.

If a repair is necessary, please proceed as follows:

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and, if need be, also a safety data sheet outside on the packaging
- Please contact for the return shipment the agency serving you. You can find the agency on our home page www.vega.com.

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8 Dismounting

8.1 Dismounting steps

Warning:
Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel or pipeline, high temperatures, corrosive or toxic products etc.

Take note of chapters "*Mounting*" and "*Connecting to power supply*" and carry out the listed steps in reverse order.

8.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the parts to be easily separable.

WEEE directive 2002/96/EG
This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws. Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

Correct disposal avoids negative effects on humans and the environment and ensures recycling of useful raw materials.

Materials: see chapter "*Technical data*"

If you have no way to dispose of the old instrument properly, please contact us concerning return and disposal.

9 Supplement

9.1 Technical data

General data	
Material 316L corresponds to 1.4404 or 1.4435	
Materials, wetted parts	
– Process fitting - thread	316L
– Process fitting - flange	316L
– Process seal	Klingersil C-4400
– insulation (fully insulated)	FEP
– Probe (rod FEP fully insulated: ø 16 mm/0.63 in)	316L
Materials, non-wetted parts	
– Plastic housing	plastic PBT (Polyester)
– Aluminium die-casting housing	Aluminium die-casting AlSi10Mg, powder-coated - basis: Polyester
– Stainless steel housing - precision casting	316L
– Stainless steel housing, electropolished	316L
– Seal between housing and housing cover	NBR (stainless steel housing, precision casting), silicone (aluminium/plastic housing; stainless steel housing, electropolished)
– Ground terminal	316L
Process fittings	
– Pipe thread, cylindrical (DIN 3852-A)	G½ A, G¾ A, G1 A, G1½ A
– American pipe thread, conical (ASME B1.20.1)	½ NPT, ¾ NPT, 1 NPT, 1½ NPT
– Flanges	DIN from DN 25, ANSI from 1"
Weight	
– Instrument weight (depending on process fitting)	0.8 … 4 kg (0.18 … 8.82 lbs)
– Rod weight: ø 16 mm (0.63 in)	1100 g/m (12 oz/ft)
Sensor length (L)	0.2 … 4 m (0.656 … 13.12 ft)
Active sensor length (L1)	0.05 … 0.3 m (0.16 … 1 ft), standard: 100 mm (3.9 in)
Max. lateral load	10 Nm (7.4 lbf ft)
Max. torque (process fitting - thread)	100 Nm (73 lbf ft)

Output variable	
Output signal	in the range of 4 … 20 mA
Suitable signal conditioning instruments	e. g. VEGAMET 381, 391, 513, 514, 515, 624
Fault message	> 22 mA
Current limitation	28 mA

Load	see load diagram under Power supply
Damping (63 % of the input variable)	0.1 s
Met NAMUR recommendation	NE 43

Input variable

Measured variable	level of conductive, adhesive liquids
Measuring principle	phase-selective admittance processing (PSA)
Measuring range	
– range 1	0 … 120 pF
– range 2	0 … 600 pF
– range 3	0 … 3000 pF
Measuring frequency	430 kHz

Accuracy (according to DIN EN 60770-1)

Reference conditions according to DIN EN 61298-1	
– Temperature	+18 … +30 °C (+64 … +86 °F)
– Relative humidity	45 … 75 %
– Air pressure	860 … 1060 mbar/86 … 106 kPa (12.5 … 15.4 psig)
Temperature error	
– < 120 pF	< 1 pF
– > 120 pF	1 % of the current measured value
Linearity error	< 0.25 % of the complete measuring range

Ambient conditions

Ambient, storage and transport temperature	-40 … +80 °C (-40 … +176 °F)

Process conditions

Process pressure	-1 … 64 bar/-100 … 6400 kPa (-14.5 … 928 psig)
Process temperature VEGACAL 64 of 316L	-50 … +150 °C (-58 … +302 °F)

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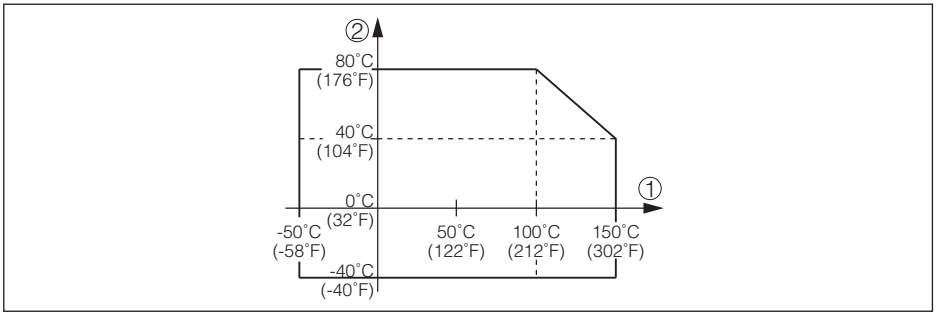

Fig. 14: Ambient temperature - Process temperature

1 Process temperature
2 Ambient temperature

Dielectric constant	≥ 1.5

Electromechanical data - version IP 66/IP 67 and IP 66/IP 68; 0.2 bar

Cable entry/plug[1)]	
– Single chamber housing	– 1 x cable gland M20 x 1.5 (cable: ø 5 … 9 mm), 1 x blind plug M20 x 1.5 or: – 1 x closing cap ½ NPT, 1 x blind plug ½ NPT or: – 1 x plug (depending on the version), 1 x blind stopper M20 x 1.5
Spring-loaded terminals	for wire cross-section up to 2.5 mm² (AWG 14)

Electromechanical data - version IP 66/IP 68 (1 bar)

Cable entry	
– Single chamber housing	– 1 x IP 68 cable gland M20 x 1.5; 1 x blind plug M20 x 1.5 or: – 1 x closing cap ½ NPT, 1 x blind plug ½ NPT

Voltage supply

Operating voltage	
– Non-Ex instrument	12 … 36 V DC
– EEx-ia instrument	12 … 30 V DC
– EEx-d-ia instrument	18 … 36 V DC

[1)] Depending on the version M12 x 1, according to ISO 4400, Harting, 7/8" FF.

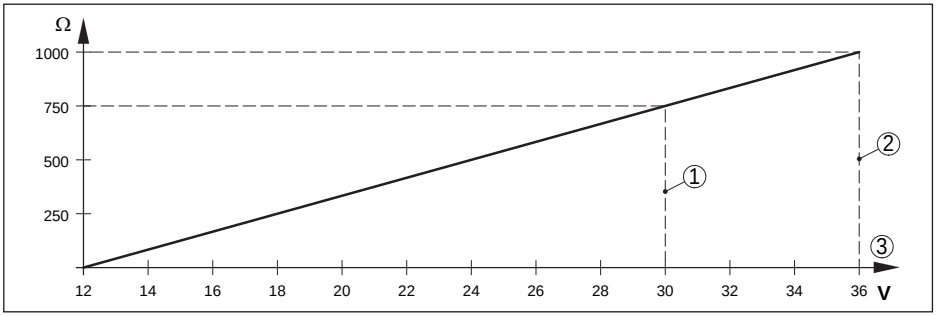

Fig. 15: Voltage diagram

1 Voltage limit EEx-ia instrument
2 Voltage limit non-Ex/Ex-d instrument
3 Operating voltage

Operating voltage with illuminated display and adjustment module

– Non-Ex instrument	20 … 36 V DC
– EEx-ia instrument	20 … 30 V DC
– EEx-d-ia instrument	20 … 36 V DC
Permissible residual ripple	
– < 100 Hz	U_{ss} < 1 V
– 100 Hz … 10 kHz	U_{ss} < 10 mV
Load	see diagram

Electrical protective measures

Protection, depending on housing version	
– Plastic housing	IP 66/IP 67
– Aluminium housing, stainless steel housing - investment casting, stainless steel housing - electro-polished	IP 66/IP 68 (0.2 bar)[2)]
– Aluminium and stainless housing, investment casting (optionally available)	IP 66/IP 68 (1 bar)
Overvoltage category	III
Protection class	II

Approvals

Instruments with approvals can have different technical data depending on the version.

For that reason the associated approval documents of these instruments have to be carefully noted. They are part of the delivery or can be downloaded under www.vega.com via "*VEGA Tools*" and "*serial number search*" as well as via "*Downloads*" and "*Approvals*".

2) A suitable cable is the prerequisite for maintaining the protection rating.

9.2 Dimensions

Housing in protection IP 66/IP 67 and IP 66/IP 68; 0.2 bar

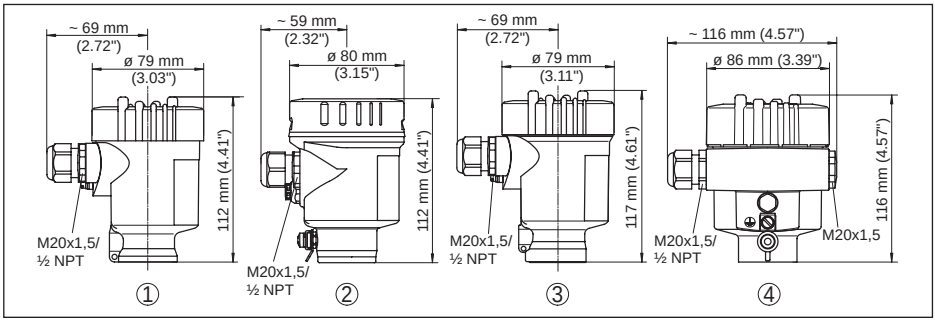

Fig. 16: Housing versions in protection rating IP 66/IP 67 and IP 66/IP 68, 0.2 bar (with integrated display and adjustment module the housing is 9 mm/0.35 in higher)

1 Plastic housing
2 Stainless steel housing, electropolished
3 Stainless steel housing - precision casting
4 Aluminium housing

Housing in protection IP 66/IP 68, 1 bar

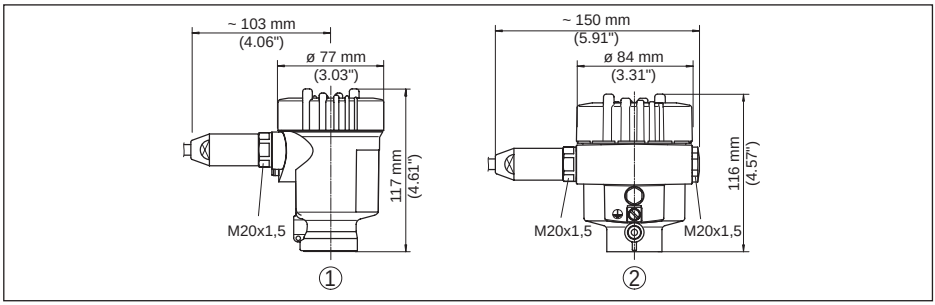

Fig. 17: Housing versions in protection IP 66/IP 68, 1 bar (with integrated PLICSCOM the housing is 9 mm/0.35 in higher)

1 Stainless steel housing
2 Aluminium housing

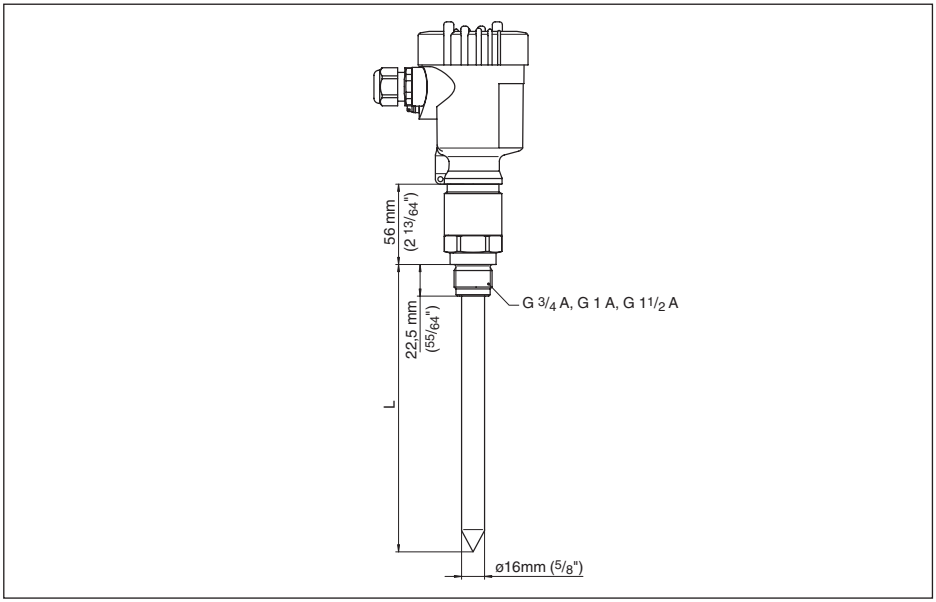

Fig. 18: VEGACAL 64, threaded version G1 A (ISO 228 T1)

L = Sensor length, see chapter "Technical data"

9.3 Industrial property rights

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Only in U.S.A.: Further information see patent label at the sensor housing.

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All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.
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